

FIG. 1

100
↓

```
<!-- Quality of Service Request Message --><!-- Common Shared Attribute Definition -->
<!ENTITY % time-unit ' unit  (millisecond|second|minute|hour|day) "second">
...
<!-- Root Element: Quality of Service Message          -->
<!ELEMENT qos-message (profile?, performance?, reliability?, timeliness?, security?)>
<!-- profile encodes the information regarding the requesting client and the messages -->
<!ELEMENT profile (client?, topic?, content-type*)>
... 116 ~~~~~ 104 ~~~~~ 110
<!ELEMENT performance (response-time?, throughput?, volume-rate?, delay?, pay-load?)>
<!ELEMENT response-time EMPTY>
<!ATTLIST response-time %time-period;>
<!-- response-time is the time spent by a single node (e.g., InfoBroker) -->
<!-- from the time a publication is received to the time it is delivered -->
... ~~~~~ 104 ~~~~~ 110
<!ELEMENT reliability (delivery?, loss-probability?, error-rate?, retry?, persistency?, criticality?)>
<!ELEMENT delivery EMPTY>
<!ATTLIST delivery guaranteed-delivery (yes|no) "no"
                           duplication-elimination (yes|no) "no"
                           message-ordering (no|yes) "no">
<!-- corresponds to the Web Service Reliability attributes -->
... ~~~~~ 104 ~~~~~ 110
<!ELEMENT timeliness (time-to-live?, deadline?, priority?)>
<!ELEMENT time-to-live EMPTY>
<!ATTLIST time-to-live %time-period;>
<!-- relative to the time when the message is received -->
.....
<!ELEMENT security (signature?, encryption?)>
...
... ~~~~~ 104 ~~~~~ 110
```

Fig. 2

Title: QUALITY OF SERVICE RESOURCE MANAGEMENT APPARATUS AND METHOD FOR
MIDDLEWARE SERVICES
Inventors: Guijun Wang, et al
Atty. Ref.: 7784-000719
Attorney Elizabeth D. Odell (314) 726-7500

3/7

200

```
<?xml version="1.0"?>
<!DOCTYPE qos-message SYSTEM "QoSMessage.8.dtd">
<qos-message>
  <profile>
    <client name='Pub1' role='publisher'/>
    <topic>Logistics</topic>
    <content-type>text</content-type>
  </profile>
  <performance>
    <volume-rate unit='second'>100</volume-rate>
    <pay-load volume='32' unit='kilobyte'/>
  </performance>
  <reliability>
    <delivery guaranteed-delivery='yes'/>
    <criticality level='red'/>
  </reliability>
</qos-message>
```

F(G. 3)

4/7

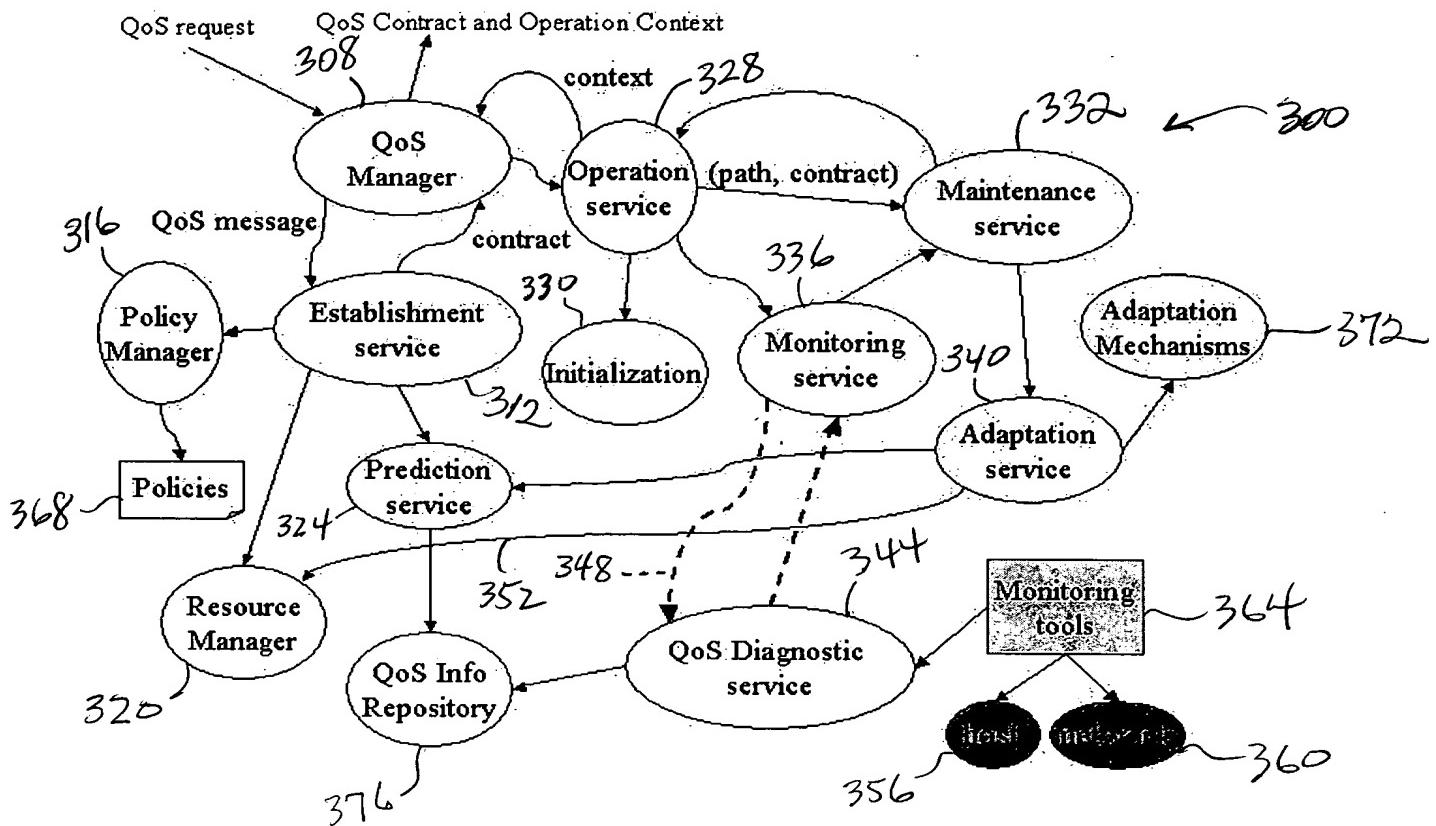


FIG. 4

Title: QUALITY OF SERVICE RESOURCE MANAGEMENT APPARATUS AND METHOD FOR
MIDDLEWARE SERVICES
Inventors: Guijun Wang, et al
Atty. Ref.: 7784-000719
Attorney Elizabeth D. Odell (314) 726-7500

5/7

```
public interface QosManager {  
    408   QoSContract establishQosContract (String clientID, String qosMessage)  
          throws QosManagerChannelException;  
    412   QoSContract reviseQosContract (String clientID, String qosMessage)  
          throws QosManagerChannelException;  
    416   void agreeQosContractOffer (String clientID, QoSContract contract)  
          throws QosManagerChannelException;  
    420   void abortQosEstablishment (String clientID, QoSContract contract)  
          throws QosManagerChannelException;  
}
```

400

FIG. 5

6/7

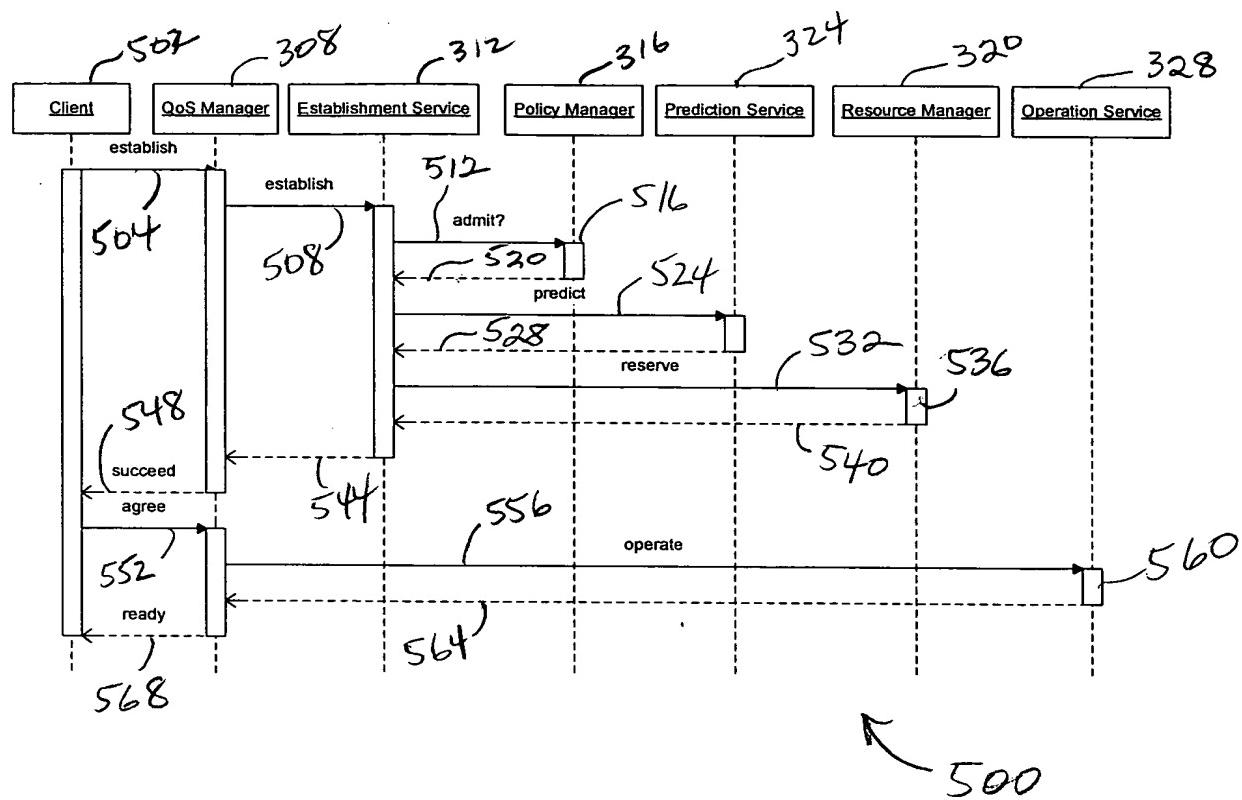


FIG. 6

Title: QUALITY OF SERVICE RESOURCE MANAGEMENT APPARATUS AND METHOD FOR
MIDDLEWARE SERVICES
Inventors: Guijun Wang, et al
Atty. Ref.: 7784-000719
Attorney Elizabeth D. Odell (314) 726-7500

7/7

600

```
public abstract class Resource {  
    protected boolean sharable;  
  
604    public static Resource create(QoSContract contract, Element config, Class clazz) throws ...;  
644    public void attach(QoSContract contract) throws ResourceException;  
608    public void configure(QoSContract contract, Element config) throws ResourceException;  
        public void reconfigure(QoSContract contract, Element config) throws ResourceException;  
616    public void cancel(QoSContract contract) throws ResourceException;  
612    public void commit(QoSContract contract) throws ResourceException;  
628    public void release(QoSContract contract) throws ResourceException;  
  
620    public void activate() throws ResourceException;  
624    public void freeze() throws ResourceException;  
  
632    public Prediction predict() throws ResourceException;  
636    public void register(QoSContract contract, Monitor monitor) throws ResourceException;  
        public void unregister(QoSContract contract, Monitor monitor) throws ResourceException;  
640    public void adapt(QoSContract contract, Adaptation adaptation) throws ResourceException;  
    }  
}
```

FIG. 7